Egyptian J. of Phycol. Vol. **6**, 2005

CHANGES IN PHYSICO-CHEMICAL CHARACTERS AND ITS IMPACT ON PHYTOPLANKTON STRUCTURE OF LAKE MANZALA.

Rawheya A. Salah El Din.
Botany and Microbiology Dept., Fac. of Sci., Al-Azhar Univ. (Girl Branch).

Abstract

The changes in phytoplankton and physico-chemical characters of Lake Manzala were studied during the period from January 2003 and March 2004. Water samples collected from ten stations representing four sectors. The physico-chemical is highly loaded of different source of pollution. Phytoplankton standing crop and diversity were highly affected by the high amount of pollution effluents into the Lake. The species composition of the main algal groups showed distinct variations. The dominance of algal groups at the Lake was in the following order Bacillariophyta (54.75 %), Chlorophyta (39.31 %) and Cyanobacteria (4.83 %) were the most dominant groups. However, Dinophyta (0.73 %) and Euglenophyta (0.37 %) were not detected during summer season. Diatoms species dominate in all sectors all year around.

Introduction

Lake Manzala is the largest of five lakes found in the North of Delta Nile. It North East lies between 31^{o}00 and 31^{o}30" latitude and 31^{o}45" and 32^{o}20" longitude. Several Decades ago, lake Manzala area was 1,698 km^2, however, continuous land reclamation projects established to meet a rapidly growing population have resulted in a significant decrease in the size of the lake, reaching 770 km^2 in 1988. Existing plans may reduce it to 469 km^2. Land reclamation for agriculture together with the introduction of perennial irrigation, the construction of canals and drains, and discharge of nutrients has greatly modified Lake Manzala water quality. Today, low saline levels near drain and canal outlets in the south and west characterize the lake, saline waters in the extreme North-West, and brackish waters over most of the remaining areas (El-Kafrawy, 2004).

Several previous studies were carried out on hydrograph, physico-chemical characteristics, ecology, hydrophytes and plankton such as (Hamza 1985; Ibrahim, 1989 and EL-Sabrouti, 1990).

The water quality deterioration due to pollution may dramatically affect the primary producers of aquatic ecosystem chain. However, the change of algal communities is most commonly a response to the increase of water pollution and to the influence of season. Therefore, the excessive algal population (eutrophication) is a problem having a worldwide central concern and the degree of water pollution can be evaluated by characterizing the aqua tire communities in the habitat (Wu, 1984).

(ISSN: 1110-8649)

The studies of primary productivity and biomass in Lake Manzalah were investigated by MacLaren (1982) and Zaghloul (1994). Meanwhile, the effect of organic pollution on the distribution and content of phytoplankton in Lake Manzalah were studied by Ezzat (1989). Meanwhile, Zaghloul and Halim (1990) provide evidence that phytoplankton density and species composition undergo significant changes within the year round. These changes have been termed 'seasonal succession' by many plankton ecologists. However, the impact of pollution on the phytoplankton of the coastal marine environment and evidence that changes in the water quality in the polluted area have an adverse effect on the productivity of water, has been studied by Zaghloul (1994).

The aim of this work is to investigate the seasonal effects of extreme changes in the physico-chemical parameters of the lake water quality on the phytoplankton community.

Materials and Methods

<u>1- The Study area and Sampling:</u>

Lake Manzala is the largest Delta lagoon in Egypt. It is located, between 31º 31 30 N lat. and 31º 45 32 E long Fig. (1). It is bounded by the Mediterranean Sea to the north, Suez Canal to the east, Damietta province in the west and Dakahlia and Sharkia provinces from the south. There are three narrow outlets at El-Boughdadi, El-Gamil and EI-Qaboti at the northern side of the lake. The sampling scheme used in the current study was designed to distinguish between 10 stations. The investigated stations are geographically positioned using GPS and their distribution was plotted as shown in Figure (1). These ten stations covered the four major sectors of the Lake and collected as follow (Eastern sector composed of stations 1, 2 and 3; Northern sector included station 4 and 7; Southern sector composed of stations 5, 6 and 8; the last sector was the Western sector included stations 9 and 10). The previous stations were visited in seasonal bases during 2003-2004.

Water analysis:

The physicochemical characteristics including the water temperature, pH, conductivity, total dissolved solids, salinity, dissolved oxygen and dissolved oxygen saturation were obtained directly in the field at each station by using the Mettler Toledo probes. These probe measurements were calibrated for each of these parameters following the procedures described by American Public Health Association (APHA) (1995). Whereas, turbidity, chloride, sulphate, carbonate, phosphate-P, nitrate-N, silicate-Si, major cations (Na^+, K^+, Ca^{2+}, Mg^{2+}) and chlorophyll-"a" were determined according to the methods recommended by the APHA (1995). Also, the water transparency of the Lake was measured using a white enameled Secchi disc. The degree of transparency was calculated as the maximum distance where the disc could be seen to the nearest Cm.

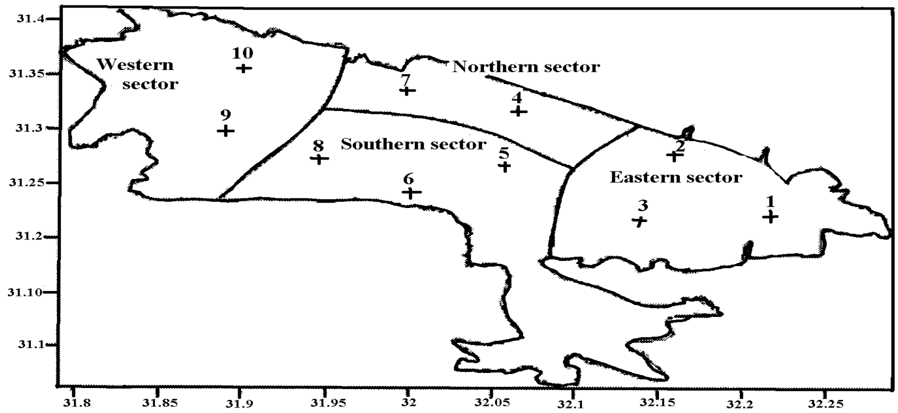

Figure (1): The selected 10 stations at Lake Manzala.

The total organic carbon content was obtained as percentage loss of weight of the dried sediment sample after ignition. The ignition loss procedure was described by (Dean, 1974) which is a modification of the procedure described by (Galle and Runnels, 1960). Dissolved oxygen (DO), biological oxygen demand (BOD) and ammonium (NH_4-N) samples were collected first from Nisken's bottle then fixation was carried out for each of DO and NH_4-N samples just after collection. DO was determined (to calibrate that of the probe) at the same day of collection using the classical Winkler method. DO samples was measured initially and after incubation for 5 days at 20 °C. The BOD values were computed from the differences between the initial and final DO concentrations.

Planktonic community and Counts

The plankton samples were collected as horizontal samples from the subsurface area of the lake using plankton nets. The samples were then concentrated into 500 ml bottle and preserved using 4% formalin. Three samples were collected from each of the ten sampling stations at season intervals between January 2003 and March 2004. After returning to the laboratory, samples were poured into glass cylinder and few drops of Lugol solution were added. After 5-day sedimentation, the supernatant was siphoned off by plastic tube ended with plankton cloth of 50µm mesh diameter. Algal and diatoms genus were identified according to the proper key of identifications (Riley, 1967; Nygaard, 1976;

Palmer, 1980; Bourrelly, 1980 and Prescott, 1982). Identification was carried out under bright field, with a binocular microscope (Olympus CH 40).

Result and Discussion

The results of some physico-chemical characters of the sampled water are given in Table (1). Data in Table (1) showed that the water temperature of the lake varied during the four seasons of the year but more or less was similar at the four sectors. Temperature was low in winter season (14.45-15.5 ^{o}C), moderate in autumn and spring seasons (20.53-26.6 ^{o}C) and warm in summer (29.25-33.10 ^{o}C). It appeared that these temperatures are suitable for algal growth as well as the fluctuation of phytoplankton standing crop in the four sectors. This data agrees with that recorded by (Deyab *et al*., 2000 and Shaaban-Dessouki *et al*., 2004). The pH values of water at all the studied sites of the lake during the four seasons are generally on the alkaline side, ranging between 8.12 during summer and 8.86 during spring at the southern sector of the lake. This general tendency towards alkaline side could be mainly due to activation of photosynthetic process of dense phytoplankton populations at the lake. Such assumption seemed to be conformity with finding of Qijun *et al.* (1994) and El–Attar (2000).

Data in Table (1) indicate increases in conductivity, total dissolved solid, salinity and chloride in the northern sectors during summer season (50.04 mS/Cm; 25.23g/L; 32.84 % and 16.04 g/L, respectively). This increase may be attributed to the direct contact with the Mediterranean Sea. Other increases in the lake was recorded also in summer at the eastern sector this could be attributed to domestic wastes or agriculture wastes mixed into the canal which agree with the finding of (Kebede *et al*., 1994 and El-Kafrawy, 2004). Transparency can be factor effecting on the phytoplankton population. The present study revealed that the transparency of the lake is higher than those recorded by (El-Bokhty, 1996).

Sulfates are used for a variety of commercial purposes, including products such as copper sulfate, which is used as a fungicide and algicide (U.S. EPA, 1990). It is perhaps relevant to mention that the nature of the lake for the levels of sulfate contents had changed approximately 13 fold than those recorded by Fathi *et al*. (2001).

Over all, sulfates were out of the level limits, as it is recommended that sulfate in water should not exceed 250 mg/L, except when no more suitable supplies are or can be made available. Sulfates can contribute to an undesirable taste in water. The taste threshold for the sulfate ion in water is 300-400 mg/L (NAS, 1977), and a guidance value of 400 mg/L based on aesthetic quality has been suggested (WHO, 1984). The Drinking Water Standards Contaminant Level for sulfate, based on organoleptic effects, is 250 mg/L (U.S. EPA, 1990).

Table (1): average values of some physico-chemical characteristics of water at Lake Manzala during 2003-2004

Parameters	Eastern Sector				Northern Sector				Southern Sector				Western Sector			
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
Depth (Cm)	102				133				133				134			
Water Temp	20.53	30.20	26.10	15.50	21.20	29.25	25.85	14.45	21.47	33.10	26.47	15.17	22.05	32.45	26.60	14.50
pH	8.88	8.56	8.38	8.18	8.85	8.14	8.15	8.28	8.86	8.12	8.32	8.28	8.87	8.32	8.16	8.15
Cond. (mS/cm)	10.78	25.33	11.26	7.68	12.16	50.04	31.40	10.15	4.86	9.20	7.68	6.33	9.39	17.70	9.48	6.86
TotalDissolved solid (g/l)	5.41	12.71	5.31	3.85	6.09	25.23	14.81	5.07	2.50	4.57	3.62	3.16	4.70	9.48	4.47	3.43
Salinity	6.20	15.97	6.40	4.23	6.95	32.84	17.84	5.70	2.63	5.20	4.36	3.47	5.35	11.17	5.39	3.82
DO (mg/l)	13.34	11.32	9.59	11.61	9.14	7.50	7.51	13.45	9.46	9.76	5.96	5.55	9.75	11.97	5.77	3.22
BOD (mg/l)	12.37	11.67	8.80	9.67	10.50	7.90	6.40	5.99	8.87	14.83	6.01	4.64	7.65	8.70	6.96	6.21
Trans. (cm l)	44.33	33.33	33.33	25.00	87.50	72.50	62.50	60.00	55.00	63.33	53.33	51.67	80.00	77.50	45.00	65.00
Chl-a (mg/l)	4.84	3.45	3.16	5.58	5.07	5.37	5.07	6.01	8.48	9.11	10.64	7.17	4.29	2.82	2.31	4.84
Total alkalinity (meql)	3.37	6.10	6.63	4.57	4.45	4.65	7.35	4.15	4.94	6.92	7.59	4.27	4.03	5.98	7.13	6.05
Alkalinity (Carbonate) (meql)	0.17	0.00	0.53	0.00	0.06	0.00	0.70	0.14	0.12	0.70	0.71	0.17	0.69	0.57	0.61	0.25
Chlorides (g/l)	8.27	6.32	3.55	1.71	15.95	16.04	10.00	2.66	2.36	4.67	2.41	1.60	5.14	5.94	2.98	1.95
Sulphate (mg/l)	1149.67	934.67	488.00	291.33	2364.50	2349.50	1326.50	411.50	405.00	701.67	342.00	239.00	883.50	881.00	410.50	233.50
Na (g/l)	5.42	4.11	2.08	1.07	10.37	10.43	6.11	1.80	1.53	3.04	1.36	0.99	3.34	3.92	1.67	1.22
Mg (mg/l)	500.00	407.33	331.33	247.00	1071.50	1689.00	707.00	249.00	243.00	409.00	277.00	222.67	261.00	383.00	321.00	328.00
Ca (mg/l)	407.33	354.33	170.67	120.00	641.50	461.00	214.50	100.00	126.67	166.67	106.67	66.67	368.40	212.84	106.00	70.00
K (mg/l)	188.33	155.67	82.67	52.43	387.00	391.50	233.50	71.70	66.67	116.67	60.67	42.43	143.54	146.50	68.50	41.55
Amm. (NH4-N) mg/l	30.22	59.37	19.47	84.21	2.18	3.73	1.73	1.65	6.62	5.25	3.33	5.44	3.70	5.50	4.40	1.68
Nitrite (NO3-N) mg/l	0.44	0.77	15.95	16.68	0.12	0.08	3.12	2.03	0.18	0.16	0.29	12.57	0.15	0.04	0.08	1.39
Nitrate (NO2-N) mg/l	3.21	3.34	4.69	3.47	1.61	1.95	2.54	0.17	2.70	3.80	0.74	1.20	2.20	2.58	0.53	0.12
TN (mg/l)	239.80	298.63	118.27	293.03	117.95	128.50	91.55	188.15	139.77	290.00	83.33	139.77	126.90	145.85	83.85	95.25
(PO4-P) mg/l	2.89	4.84	7.64	4.92	4.92	1.41	2.94	0.57	0.72	0.92	2.92	0.78	0.28	0.24	3.00	0.18
TP (mg/l)	18.39	7.74	7.70	5.92	15.19	10.71	5.90	2.70	17.34	15.19	7.06	2.77	7.89	8.71	4.60	1.09
(SiO4-Si) mg/l	50.93	79.33	92.90	64.56	64.56	61.53	50.10	63.00	111.53	110.97	87.37	139.85	120.00	144.35	166.25	161.40

Dissolved oxygen concentration (DO) along the studied area is sufficient for covering the demands of aquatic organisms at all seasons. The highest values of DO were 13.45 mg/L at northern sector were recorded in winter season. In general, variations in DO between sectors are mainly due to the biological activities of fauna and flora that release or consume oxygen (Saad, 1978). Also, it may be related to the increase of photosynthetic activity, which liberates a significant amount of O_2 to the water. In this respect, Abd El-Hamid *et al*. (1992) and Siliem (1993) stated that the relatively high concentrations of DO were mostly associated with increasing phytoplankton population. Taha *et al*. (2001) recorded a positive correlation between DO and phytoplankton standing crop, due to high concentration of DO which produced during photosynthetic activity of phytoplankton. Also, the data in table (1) showed considerable variations in biological oxygen demand between the different sectors of the lake.

Alkalinity of water is primarily a function of its carbonate, bicarbonate and hydroxyl ions, so it is taken as an indication of the concentration of these constituents. The low level of carbonate at all sectors or some time were not detected may be attributed to the high DO, these results agree with the finding of Siliem (1984) who reported that the alkalinity is quite related to DO, the highest alkalinity may be attributed to lower DO content. The lower O_2 is indication of higher content of CO_2 or vice versa. But the total alkalinity was found relatively high in all sectors of the lake ranged between 3.37 - 7.59 meq/L. This increase in total alkalinity may be attributed to different sources of pollutant drainage into the lake.

Although the data revealed that the sodium concentration in the northern sector is much higher than all other sector during spring, summer and autumn this attributed to the direct contact with the Mediterranean Sea and the low concentration during the winter season. It may be result of the rain and closing the outlet which reduce the sea water to be introduced to the lake. But even so, the value of divalent (calcium and magnesium) and the monovalent cations (sodium and potassium) were relatively higher than those recorded by Fathi *et al*. (2001) in their work on the CASSARINA Project during 1998.

In addition, the concentrations of various nutrient contents were investigated and recorded in Table (1) such as total nitrogen ammonium, nitrite and nitrate; total phosphorus and phosphates as well as silicate. Phosphorus is considered the most frequently limiting element because its concentrations in surface water are often low compared to other nutrients affecting on the succession of phytoplankton (Falkner *et al.*, 1995). In the present study the lake showed wide fluctuations in phosphate and total phosphorus content. Data also revealed that silicates have high fluctuation in all sectors as well as Bacillariophyta members. In this connection, it should be recalled that Fathi and Kobbia (2000) reported that silica is essential for Bacillariophyta.

In Table (1) the concentration of ammonia was very high at the eastern sector (19.47-84.21 mg/L). This high concentration may be attributed to high pollution mainly due to domestic and agricultural wastes which in turn decomposed by the bacterial effect and produced a high amount of NH_4. In this connection Abd El-Star (1998), pointed that, ammonia in excess of 1mg l^{-1} is considered as indicator of organic pollution. Riley and Chester (1971) stated that nitrite concentrations in aquatic environment were affected by the bacterial activity, phytoplankton uptake, oxidation reduction reactions and the inputs of domestic water which affected concentration markedly in water. In this respect the concentration of nitrite is considered very low except in winter season at eastern and southern sector also at eastern sector in autumn season with concentrations of (16.68, 12.57 and 15.95 mg/L respectively). Nitrate is the most abundant form of combined inorganic nitrogen in lake. Nitrate is variable in all sectors of the lake because they are involved in biological processes and can be incorporated into organic or structural compounds within living organisms (Payne, 1986).

Also, the results demonstrated in Table (1) revealed that chlorophyll a contents of the lakes at all sectors were more or less correlated with the total phytoplankton counts through the study period. The results in Table (2) revealed that the recorded species at all sectors contributed to 57 species, out of these 18 species belong to Chlorophyta and 18 species to Bacillariophyta representing percentage of (31.58 %) each, 14 species to Cyanobacteria (24.56 %), 6 species to Dinophyta (10.53 %) and only one species to Euglenophyta (1.75 %). The study of the density of algae within the area showed that the standing crop ranged from 18093 individuals during winter season to 2944837 individuals during autumn season. The intensity of algae among all sectors samples indicated that autumn season had the greatest number of individuals, representing 46.756% of the total number of species, followed by summer season (29.05 %) then spring season (23.91%) and winter season had the lowest number of individuals in all sectors with percentage of 0.29%.

Bacillariophyta as diatoms constituting 31.58 % of the total algal species of all water samples from the four sectors the pennales forms were predominately by *Nitzschia* sp., *Navicular* sp., and *Amphora ovata typical*. Pennales generally exhibit strong oligotrophic tendency (Swayer, 1966; kobbia *et al*., 1990 and El-Attar, 2000). The data also show that Bacillariophyta members have the greatest number of individuals in all sectors all seasons (Table 3 and figure 2).

The results present in table (3) and Fig. (2) showed that Chlorophyta is the second greatest number of individuals in all side of the lake and they were represented mostly by Chlorococcales the predominant species *Ankstrodesmus falcatus*; *Oocystis lacustris*; *Scenedesmus bijuga*; *Scenedesmus quadricauda* and *Crucigenia* sp. These species are considered as eutrophic plankton type and found in water containing high levels of phosphate and nitrate according to (Hutchinson,

Table (2): A list of recorded phytoplankton

Genera	Spring				Summer				Autumn				Winter			
	E	N	S	W	E	N	S	W	E	N	S	W	E	N	S	W
Chlorophyta																
Ankstrodesmus falcatus var. *accularis* (Brown) G. S. West	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cardiomonas sp.	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Carteria sp.	-	-	-	-	-	-	-	-	+	+	+	-	+	+	-	-
Chlamydmonas sp.	-	+	+	+	-	-	-	-	+	-	+	+	+	-	-	-
Chlorella vulgaris Beyerink	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	-
Coelastrum sp.	+	+	+	+	-	+	-	-	-	-	+	+	-	-	-	-
Cosmarium sp.	-	-	-	-	+	-	+	+	-	+	+	-	+	-	-	+
Crucigenia tetrapedia	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Dictyosphaerium pulchellum Wood	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-
Gleocystis major Gerneck	-	-	-	-	+	-	+	+	+	+	+	-	+	-	-	-
Kirchinerella contorta Bohlin	-	-	-	-	+	+	+	+	+	+	+	-	+	-	-	-
Oocystis lacustris Chodat	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-
Pediastrum duplex	+	-	+	-	-	-	-	-	-	+	+	-	-	-	-	-
Scenedesmus acuminatus Chodat	+	+	-	+	-	+	-	-	-	+	+	+	+	+	-	-
Scenedesmus bijuga (Turp.) Lag.	+	-	+	+	+	-	+	+	+	-	+	+	+	+	+	-
Scenedesmus quadricauda (Turp.) Lag.	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	-
Selenastrum sp.	-	-	+	+	-	+	+	+	-	-	-	-	-	-	-	-
Tetraedron muticum (A.Braun) Hansgirg	-	+	-	-	+	+	+	-	-	-	-	-	-	-	-	+
Cyanobacteria (Blue green algae)																
Anabaena variabalis Kutz	-	-	-	-	+	-	+	-	-	+	+	-	-	+	+	+
Anabaenopsis elenkinni Miller	+	-	+	-	+	+	+	+	-	+	+	-	-	-	-	-
Aphanocapsa sp.	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	-
Chroococcus turgidus Nagel	+	+	+	+	-	-	-	+	+	-	-	+	-	-	-	+
Coelosphaerium sp.	-	+	-	-	-	-	-	-	+	-	-	-	-	-	+	+
Dactylococcopsis sp.	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Gloecapsa aeruginosa (Garm.)	+	+	+	+	-	-	-	-	+	+	-	+	+	-	+	-
Gomphosphaeria lacustris var. *compacta* Lemm.	-	-	-	-	-	+	+	-	-	+	-	-	-	-	+	-
Lyngbya majusula Harv.	-	+	+	+	-	+	+	-	+	+	+	+	+	-	-	-
Merismopedia elegans Braum	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+
Microcystis aeruginosa Kutz	+	+	+	+	-	-	-	+	+	-	+	+	+	-	+	+
Oscillatoria lemnetica Lemm.	+	+	+	+	+	+	+	+	-	-	+	+	-	+	+	+
Phormidium autumnale (Ag.) Gomont	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-
Spirulina major kutz.	-	+	-	-	+	-	-	-	+	-	+	-	+	-	-	-
Dinophyta																
Gonyaulax sp.	-	-	-	-	-	-	-	-	+	-	-	+	+	+	-	-
Gymnodiniun eurytopium	+	+	+	+	-	-	-	-	-	+	+	-	+	+	-	+
Proroconteruns sp.	+	+	+	+	-	-	-	-	-	+	+	+	-	+	+	+
Protoperidiniuns sp.	-	+	-	-	-	-	-	-	-	+	-	+	-	+	+	-
Pyrophacus sp.	-	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-
Scripcella sp.	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Euglenophyta																
Phacus pleuronectus	-	-	-	-	-	-	-	-	-	-	+	+	-	+	+	-

Table (2): continue

Genera	Spring				Summer				Autumn				Winter			
	E	N	S	W	E	N	S	W	E	N	S	W	E	N	S	W
Bacillariophyta																
Amphiprora sp.	+	+	-	-	-	-	+	-	+	-	-	-	+	-	-	-
Amphora ovata typica Cl.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+
Biddulphia laevis (Her.) Hust	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Campylodiscus sp.	-	-	-	-	-	-	+	-	+	+	+	+	+	-	-	-
Cocconies placentula (E) Grun	-	+	+	+	+	+	+	+	+	+	-	-	-	-	+	-
Cyclotella atomus	-	+	-	-	+	-	-	-	+	+	+	-	-	+	-	-
Cyclotella meneghiniana Kutz. Plana Fricke	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Fragilaria capucina	-	+	+	+	-	-	-	+	-	-	+	-	-	-	-	-
Gyrosigma sp.	-	-	-	-	+	-	-	-	+	+	+	-	-	+	-	-
Mastogloia sp.	-	-	-	-	+	+	-	+	+	-	+	-	-	-	-	-
Melosira granulata (Her.) Ralfs	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	-
Navicular sp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Nitzschia sp.	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+
Pleurosigma macrum Wm. Sm.	-	+	-	-	-	+	+	-	+	-	-	-	-	-	-	-
Rhopalodia gibba genuina Grun	-	-	-	-	+	+	+	+	+	+	-	-	+	-	-	-
Synedra ulna (Nitz.) Ehr	-	-	-	-	+	+	+	+	-	-	+	+	-	-	+	-
Thalassionema sp.	+	-	+	-	-	+	-	+	-	-	-	-	-	-	-	-
Thalassiosira fuviatiles	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-

1967 and Kobbia *et al*., 1993). In this respect Bacillariophyta was dominant over Chlorophyta during all seasons of the year this may be due to the competition for phosphate which leads to flourish of large number of diatoms over the green species which are only partly available to zooplankton as food (Sommer *et al*., 1986). Dinophyta mostly represented during spring autumn and winter and not detected at summer seasons at Southern and Western sectors.

Cyanobacteria considered the third predominant species in the lake. They are present in all seasons and all sectors. The present results are in accordance with those of Holmes and Whitton (1981) who reported that assemblages of cyanobacteria were presumably favored in most cases, since they have the ability to grow under wide range of chemical variability, similar results were obtained by Kobbia *et al*. (1993).

Dinophyta members were represented by 6 species being recorded at all sectors and being absent during summer season. The Euglenophyta were poorly represented only by one species (*Phacus pleuronectus*) during autumn and winter.

In this respect Round (1981) and El-Attar (2000) emphasized that Euglenoids often occur in deoxygenated waters.

Table (3): Total counts of phytoplankton groups of the four sectors of Lake Manzala during the studied period 2003-2004 data expressed as (cells l^{-1})

Seasons	Phyllum	Eastern sector	Northern sector	Southern sector	Western sector
Spring	Chlorophyta	186940	4845	1933	4650
	Cyanobacteria	7543	808	2785	5310
	Bacillariophyta	262256	6273	11972	6620
	Dinophyta	1275	3763	4640	1930
	Euglenophyta	0	0	0	0
Summer	Chlorophyta	60355	26428	86010	105095
	Cyanobacteria	1512	5292	11533	4457
	Bacillariophyta	100869	45539	107370	176735
	Dinophyta	0	0	0	0
	Euglenophyta	0	0	0	0
Autumn	Chlorophyta	178922	32600	165663	66028
	Cyanobacteria	1392	6100	11160	54902
	Bacillariophyta	193061	74800	204762	89428
	Dinophyta	293	1350	633	1980
	Euglenophyta	0	0	7013	883
Winter	Chlorophyta	903	305	215	185
	Cyanobacteria	41	171	75	186
	Bacillariophyta	1660	724	315	391
	Dinophyta	39	1054	46	131
	Euglenophyta	0	0	158	720

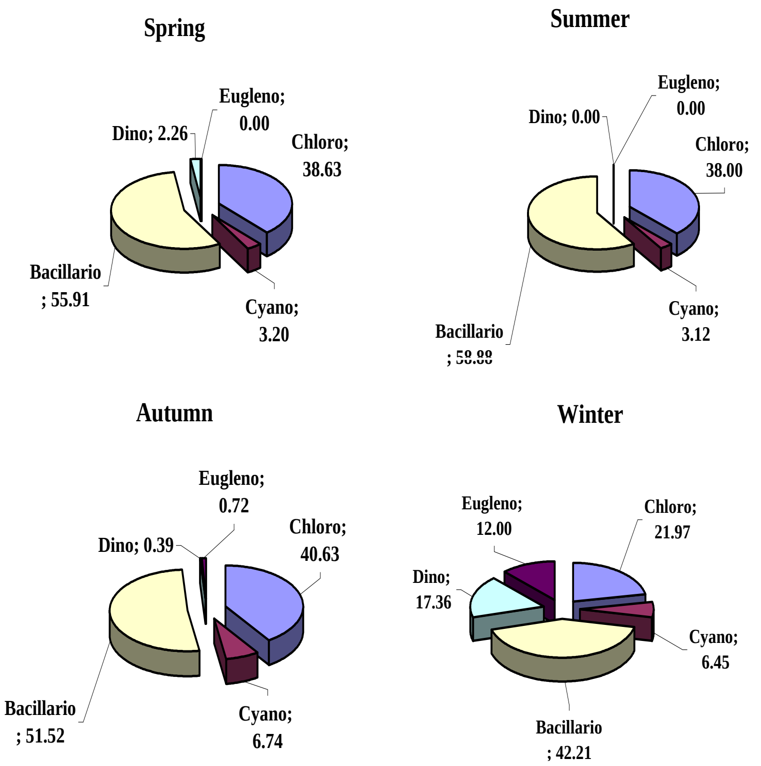

Figure (2): Seasonal variation on the algal composition of the four sectors of Lake Manzala during the studied period 2003-2004.

The distributions of planktonic species in Lake Manzala during the four studied seasons are represented in Figure (3). According to fig (3) it was clear that in spring season the high population density covering the eastern sector and scattered number of individual was found in the three other sectors. Meanwhile, the summer season the algal population changed their way of distribution and algal species covered Western, Southern and Eastern sectors respectively. In autumn the dense population was recorded in Southern and Eastern sectors respectively. Whereas the Eastern sector have dense population density followed by the Northern sector.

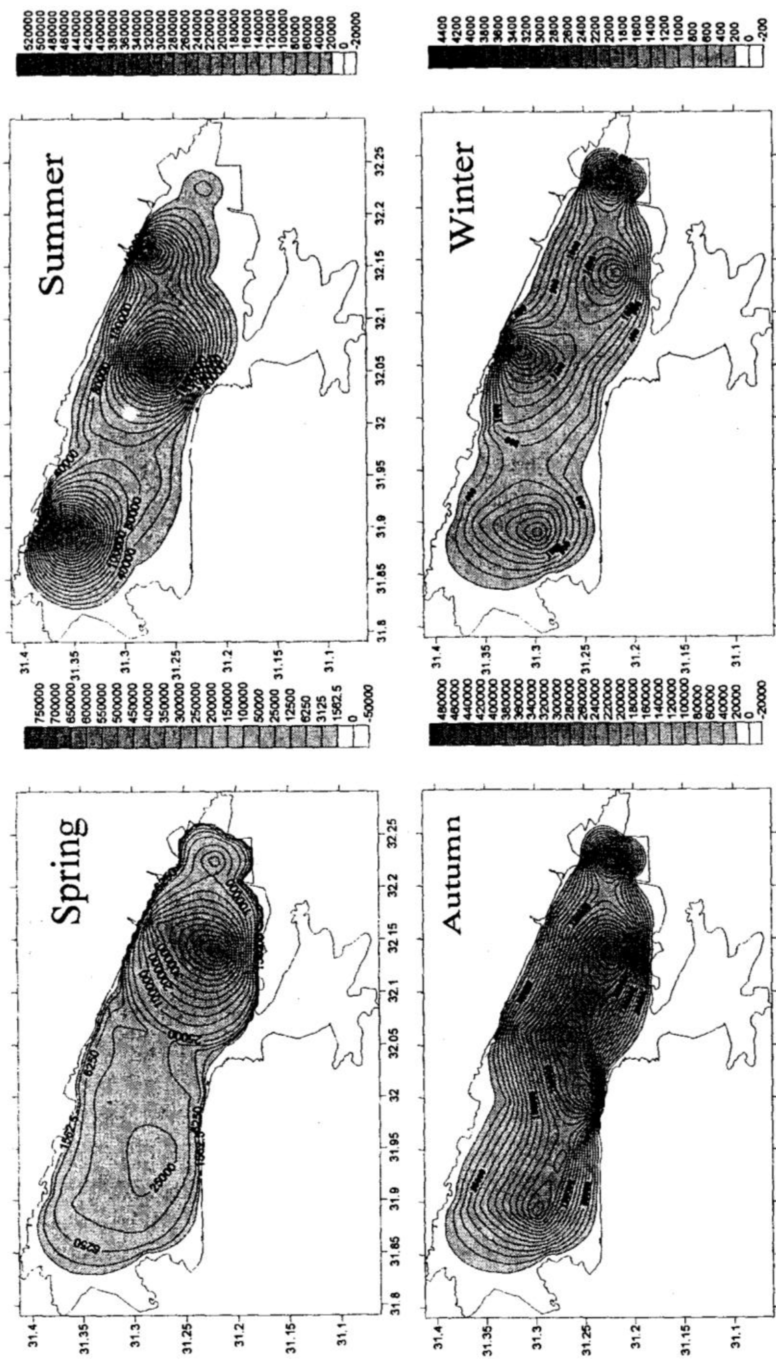

Figure (3): Diagrammatic presentation of the distribution of phytoplankton in Lake Manzala during the four studied seasons.

References

Abd El-Hamid, M. I.; Shaaban-Dessouki, S. A. and Skulbery, O. M. (1992). Water quality of the River Nile in Egypt. I.Physical and chemical characteristics. *Arch. Hydrobiol*. (Suppl. 90), **3:283-310**.

Abd El-Star, A. M. (1998). Distribution of some elements in the River Nile environment at Great Cairo region. Ph. D Thesis, Fac. of Sci. Cairo Univ., Egypt.

American Public Health Association (APHA) (1995). Standard Methods for the Examination of Water and Waste Water 19th A.P.H.A. AWWA.WPCF. American Public Health Association 1015. 15th St. N. W. Washington D.C. 20005, USA.

Bourrelly, P. (1980). Les algues d'eau douce Intitiation a la systematique Tomo II: Les algues javunes et brunes Chrysophyces, Pheophyces, Xanyhophyces et Diatomees. II Place Saint Michel Paris. **(6e)**.

Dean W. E. (1974). Determination of carbonate and organic matter in calcareous sediments and sedimentary rocks by loss on ignition: Comparison with other methods. *Jour. of Sedim. Petro*., **44:242-248**.

Deyab, M. A.; Mmdouh, M. N. and El Adl, M. F. (2000). Phytoplankton as indicators of water quality in the irrigation and drainage canals in western Damietta-Egypt. *Egypt. J. Phycol*., **1: 15-31.**

El-Attar, S. A. (2000). Changes in physico-chemical characters and phytoplankton structure of El-salam Canal in the West of Suez Canal region. *Egypt. J. Phycol*., **1:1-13**.

El-Bokhty, E. E. (1996). Distribution of bottom fauna in the Lake Manzala in relation to prevailing environmental conditions. M. Sc. Thesis, Fac. Sci., Tanta Univ., Egypt. **124pp**.

El-Kafrawy, S. B. E. (2004). Monitoring of pollution in marine environment using remote sensing and GIS system. M. Sc. Thesis. Fac. Sci., Al-Azhar Univ., **226pp**.

El-Sabrouti, M. A. (1990). Texture Chemistry and Mineralogy of the bottom sediments of Lake Manzala, Egypt. *Bull. Fac. Sci. Alex. Univ*., **30(A): 296-320**.

Ezzat, A. I. (1989). Studies on phytoplankton in some polluted areas of Lake Manzala. *Bull. Nat. Inst. Ocean and Fish, ARE*.,**15 (1): 1-19**.

Falkner, G.; Wagner, F.; Falkner, R. (1995). Influence of fluctuating phosphate supply on the regulation of phosphate uptake by blue-green alga *Anacystis nidulans*. *J. Phycol*., **31: 745-753**.

Fathi, A. A.; Abdelzaher, H. M. A.; Flower, R. J.; Ramdani, M. and Kraiem (2001). Phytoplankton communities of North African wetland lakes: the CASSARINA Project. *Aquatic Ecology*, **35:303-318**.

Fathi, A. A. and kobbia, I. A. (2000). Hydrobiological investigation on the Abu-Median Lake at El_Minia Egypt. *Bull. Fac. Sci., Assiut Univ.*, **29(1-D): 77-91**.

Galle O. K. and Runnels R. T. (1960). Determination of CO_2 in carbonate rocks by controlled loss on ignition. *J. of Sediment. Petrol*., **30: 613-618**.

Hamza, W. R. (1985). Phytoplankton production in Lake Manzalah, Egypt. M. Sc. Thesis, Fac. of Sci., Alexandria Univ., Egypt.

Holmes, N. T. H. and Whitton, B. A. (1981). Phytobenthos of the River trees and its tributaries. *Freshwater Biol*., **11:139**.

Hutchinson, G. E. (1967). A treatise on limnology, geography, physics and chemistry. New York, Tohwiley and Sons Inc., **1015pp**.

Ibrahim, E. A. (1989). Studies on phytoplankton in some polluted areas of Lake Manzalah. *Bull. Nat. Inst. Oceanogr. and Fish. ARE*., **15(1):1-19**.

Kebede, E.; Mariam, Z. G. and Ahlgren, I. (1994). The Ethiopian Rift valley Lakes: Chemical characteristics of a salinity-alkalinity series. *Hydrobiologia***, 288: 1-12.**

Kobbia, I. A.; Shabana, E. F.; Dowidar, A. E. and El- Attar, S. A. (1990). Changes in physico-chemical characters and phytoplankton structure of Nile water in the vicinity of Iron and Steel factory at Helwan (Egypt). *Egypt J. Bot*., **35(1): 25-43**.

Kobbia, I. A; Dowidar, A. E.; Shabana, E. F., Al-Attar, S. A. (1993). Succession, Biomass levels of phytoplankton in the Nile water near the Starch and Glucose Factory at Giza, (Egypt). *Egyptian Journal of Microbiology*, **28(1):131-143**.

MacLaren Engineers, Planners and scientists inc. (1982). Lake Manzala Study, Egy/76/001-07. Draft Report to the Arab Republic of Egypt, Ministry of Development and new Communities and UNEP Office for projects execution, Toronto, Canada.

National Academy of Sciences (NAS) (1977). Drinking Water and Health. **pp. 425-428.**

Nygaard, G. (1976). Taveleme Fra " Dansk Pianteplankton" En flora over de Vigtigste Ferskvands former Gyldendalske Boghandel, *Nordisk Forlag, A. S.*

Palmer, C. M. (1980). Algae and Water pollution. Castle House publications LTD. **pp.110**.

Payne, A. I. (1986). Ecology of tropical lakes and rivers. John Wiley and Sons. Chester-New York-Tronto. **pp 514**.

Prescott, G. W. (1982). Algae of the Western Great Lakes Area. Otto. Koeltz Science Publishers West Germany, **pp 977**.

Qijun, K.; Yicheng, X. and Mitsuru, S. (1994). Study on the phytoplankton in acidified waters. *China Environmental Science***, 5:350-354.**

Riley, G. A. (1967). Phytoplankton of Long Island Sound. *Bull. Bingh Oceagi Cell*., **19: 5-34**.

Riley, J. P. and Chester, R. (1971): Introduction to marine chemistry. Academic Press, London, **pp.465**.

Round, F. A. (1981). The ecology of algae. Cambridge Univ. press CB 21RP, **pp.653**.

Saad, M. A. H. (1978). Seasonal variation of some physico-chemical conditions of Shatt Al-Arab Estuary, Iraq. *Est. Const. Mar. Sci*., **6: 503-513**.

Shaaban- Dessouki, S. A.; Deyab, M. A. and Mofeed, J. (2004): Phycological assessment of water quality of River Nile Delta- Egypt. *Egyptian J. of Phycol*., **5:18-34**.

Siliem, T. A. E. (1984). Chemical studies on pollution in the Damietta Nile branch between Faraskour Dam and Ras El-Bar outlet Ph. D. Thesis, Fac. Sci., Alex. Univ., Egypt, **253pp**.

Siliem, T. A. E. (1993) Effect of pollution on the chemical composition of Lake Qarun water. *Menofiya J. Agric*., **18(3):1-20**.

Sommer, U.; Gliwicz, M.; Lampert, W. and Duncan, A. (1986). The PEG – model of seasonal succession of planktonic events in fresh waters. *Arch. Hydrobiol*., **144 (4): 429-438**.

Swayer, C. N. (1966). Basic concepts of eutrofication. *Sewage Indust. Wastes*., **38(5): 740-757**.

Taha, O .E.; Afifi, M. A. and Sobhy, E. H. M. (2001). Pysico-chemical properties and phytoplankton composition of the River Nile at Helwan area, Egypt. *J. Egypt. Acad. Soc. Environ. Develop., (D- Environmental Studies)*,**2(4): 1-29**.

U.S. EPA. (1990). National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals. *Federal Register***, 55(143): 30370.**

World Health Organization (WHO) (1984). Guidelines for Drinking Water Quality. Vol. 2. Health Criteria and Other Supporting Information.

Wu, M.X. (1984). Diurnal regulation of phosphoenolpyrvate carboxylase from Crassula. *Plant physiol*., **77:667-675**.

Zaghloul, F. A. (1994). Impact of pollution on phytoplankton in a coastal marine environment. *Bull. Nat. Inst. Oceanogr. and Fish. ARE*, **20(2): 205-221**.

Zaghloul, F.A, and Halim, Y. (1990). Phytoplankton flora and its dynamics in the eastern harbour Alexandria. *Bull. High Inst. Public Health*, **20(4):875-886**.

التغيرات فى الصفات الفيزيائيه و الكيميائيه و تأثيرها على تركيب الهائمات النباتيه فى بحيره المنزله.

روحيه عبد اللطيف صلاح الدين
قسم النبات والميكروبيولوجى- كلية العلوم- جامعة الأزهر (فرع البنات).

تم فى هذا البحث دراسة التغيرات فى الصفات الفيزيائيه و الكيميائيه و تأثيرها على الهائمات النباتيه لبحيرة المنزلة خلال أربع مواسم أبتداء من يناير 2003 حتى مارس 2004. قد تم تجميع عينات المياه والهائمات النباتيه من 10 محطات يمثلون أربع قطاعات البحيره. من خلال النتائج اتضح أن البحيره متخمه بالماد الملوثه. وأتضح أيضا أن تلك المواد الملوثه لها تأثيرها على نمو الهائمات النباتيه. كما اتضح من خلال الدراسه وجود اختلافات فى التركيب النوعى للطحالب وتم ترتيب السياده الطحلبيه امياه البحيره كالأتى: الطحالب الذهبيه(% 54.75)، الطحالب الخضراء (% 39.31)، الطحالب الخضراء المزرقه (% 4.83)، الطحالب الدينوفيتيه (% 0.73) و أخيرا الطحالب اليوجلينيه (% 0.37). أوضحت الدراسه عدم العثور على كل من الطحالب الدينوفيتيه و اليوجلينيه خلال فصل الصيف. وأن الدياتومات هى السائده فى جميع القطاعات خلال جميع فصول السنه.